but is not required for the simple continuance of life when no action is going on; and illustrates this opinion by the instance of the common garden snail.

Remarks on a Correction of the Solar Tables required by Mr. South's *Observations. By* G. B. Airy, *Esq. M.A. Fellow of Trinity College, Cambridge, and Lucasian Professor of Mathematics in the University of Cambridge. Communicated by Dr.* Young, *F.R.S., &c.* Read February 15, 1827. [*Phil. Trans.* 1827, *p.* 65.]

The discordancies observed by Mr. South between the sun's right ascension, as deduced from observation, and those given in the Nautical Almanac, follow a law so simple as not to allow of their being regarded as errors of observation, or arising from any casual cause, but justify us in attributing them to imperfections in the solar tables, with the exception of three days, in which there seems to be some ground to suspect error of computation.

A single inspection of these discrepancies, Mr. Airy observes, suffices to show that they arise almost entirely from an error in the epoch, and an error in the place of the perigee. From the peculiar form of the tables in Vince's Astronomy, which give great facility to the introduction of an error in the excentricity, he was induced at first to suspect that one might exist; but on calculation found the error in the equation of the centre so small as to be entirely insensible. He then proceeds to detail the process by which, from Mr. South's observations, he has deduced the amount of the several errors, which consist in regarding the epoch, the mean anomaly, and the equation of the centre, as erroneous by three very small unknown quantities, and forming as many equations of condition for determining them as there are observations. These combined and resolved, so as to give the most probable result, lead to the conclusions, first, that the correction of the equation of the centre is evanescent; secondly, that the epochs of the sun must all be increased by $9''$, and the epochs of the perigee each by $1' 48''$.

On the mutual Action of the Particles of Magnetic Bodies, and on the Law of Variation of the Magnetic Forces generated at different Distances during Rotation. By S. H. Christie, *Esq. M.A. F.R.S.* Read February 15 and 22, 1826. [*Phil. Trans.* 1827, *p.* 71.]

The results obtained by the author, described in a former communication, when a copper disc was made to revolve under a magnetized needle, appearing to him not likely to lead to an accurate knowledge of the law of magnetic attraction, developed during rotation, from the effect of lateral attraction; he was induced to resume the inquiry, substituting a ring for a disc, expecting that, as no lateral forces would here be called into action, the results would be more uniform, and in this expectation he was not disappointed. One of the first phenomena encountered by him in this research, was a very

great diminution of magnetic force, when a ring of the same weight was substituted for a disc; and pursuing this point of inquiry, he found that in all cases of solution of continuity, not only by cuts in the direction of radii from the centre, but in concentric annuli or otherwise, there is always a great loss of force, the magnetism of the whole being always much greater than the sum of that of the parts. He describes in detail these experiments, and the apparatus used for them. His method of estimating the intensity of the force developed, was by suspending the body, set in rotation by a revolving magnet, by a wire, and preserving a constant velocity of rotation in the magnet, to note the time when the velocity acquired by the disc, was just destroyed by the torsion of the wire, and the disc just began to revolve in a contrary direction. Applying analysis to the dynamical problem arising, he thence deduces the intensity of the force urging the suspended body. Applying the resulting formula to the experiments, he finds, in almost all cases, a small diminution in the intensity of the force as the arc of rotation increases, which he attributes to a very minute degree of magnetism accumulated in the disc, and retained by it till the revolving magnet comes round again.

In reasoning on the experiments detailed, Mr. Christie concludes that the greatest developement of magnetism in a disc, subjected to the action of revolving magnets, takes place when the axes of the magnets are vertically under points bisecting the radii, and that the magnetism decreases very rapidly as they approach the edge; thus indicating that for a full development of magnetism, a continuity of substance, in all directions from the point acted on, is principally requisite. This result is corroborated in a striking manner by the effect produced by concentric circular cuts in the disc, leaving the interior attached to the exterior in several places. On successively destroying these points of connexion, a very great diminution of force is perceived.

The effect of removing, by a circular concentric cut, the interior of a disc, appears to be, to destroy or prevent the developement of a quantity of force directly proportional to the mass removed, the magnets acting at a constant difference from the centre; and reasoning from this and other phenomena, Mr. Christie concludes that the reduction of the disc, by concentric and radiating cuts, into very small portions, though not actually to powder, would render its magnetism quite insensible.

The author next proceeds to investigate, by experiments of the same kind, the law of variation of the magnetic force regarded as depending on the distance of the revolving magnets from the suspended body, which in this case was a cylindrical annulus of copper, about 1 inch in breadth, 10 inches in internal diameter, and $\frac{1}{4}$ inch thick, weighing 32·375 ounces troy; and the axes of the magnets were made to revolve during the whole series of experiments, with an uniform velocity of five turns per second, exactly under the middle of the breadth of the annulus, being fixed vertically with their south poles upwards. He assumes, first, that the action of each magnet may be referred to a single point near its extremity; secondly, that the action may

also be referred to a single point or pole in the copper ring, somewhat in arrear of the point vertically over the magnet, as a consequence of the principles proposed by other writers on the same subject; and, lastly, that the mutual action of these poles on each other is inversely as the 4th power of their distance. Assuming then a formula with indeterminate co-efficients expressive of these conditions, and determining them by comparison of the assumed with the observed forces, he finds that the effect of a variation of distance from $\frac{1}{2}$ an inch to $2\frac{1}{2}$ (which causes a diminution of force from 1982·5 to 11·375, the ratio of nearly 200 to 1,) can be represented within a 40th of the whole force, in the extreme case where the observations are liable to the greatest errors, and in all other cases to the 100th part of the force; so that he considers this law as established by experiment. The same operations give the values of the assumed constants; and it may be remarked that these agree very nearly as deduced from different experiments, and that as a mean result, we may state the distances of its pole from the extremity of each magnet, at 105 thousandths of an inch; and the distances by which the pole of the disc is in arrear of that of the magnet, with the velocity employed, at about four tenths of an inch; and the introduction of this element gives a considerable increase of coincidence between observed and computed results.

The author next proceeds to apply similar processes of assumption and calculation to the case where the magnets were made to revolve horizontally under the ring, with their poles of the same name adjacent. In this case his observations also lead to the conclusion of a law of force, varying inversely as the 4th power, instead of the inverse square of the distance, between the poles of the magnets and the corresponding poles in the ring.

He now reversed the experiments, suspending the magnets over the ring in a vertical position, and making the ring revolve below them till the magnets had attained a state of equilibrium, between the force of the disc in one direction, and that of torsion and their own directive force in the opposite. The same result is still obtained from this experiment, viz. a variation of the force as the inverse 4th power of the distance.

Mr. Christie next enters into an analytical investigation, having for its object to ascertain how far the principle of time being required for the developement of magnetism will account for the phenomena; and the conclusion to which he arrives is, that it will do so satisfactorily. In the course of these investigations, he is led to conclude that, in certain cases, a retrograde rotation in the suspended disc might take place; and suggests the great confirmation such a fact, if observed, would afford to this theory.